

FREQUENCY OF BETA THALASSEMIA TRAIT AMONG THE HEALTHY INDIVIDUALS - A SINGLE CENTRE STUDY

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ABSTRACT

Objective: To determine the frequency of beta thalassemia trait among the asymptomatic healthy individuals.

Study Design: Cross sectional study.

Place and Duration of Study: This was carried out at Pakistan Air Force (PAF) Hospital Lahore from Jan 2016 to Jun 2017.

Patients and Methods: The subjects were both male and female who came from all over Pakistan for central medical board for selection in Pakistan Air Force. Their ages were between 18 and 28 years. Their complete blood counts were measured on Sysmex KX 21 hematology analyzer. Candidates with microcytic hypochromic indices without anaemia were screened for beta thalassemia trait. Haemoglobin (Hb) electrophoresis was done on cellulose acetate paper at alkaline PH. HbA2 estimation was done by measuring the absorbance of elute on spectrophotometer. Beta thalassemia was diagnosed if the subject had HbA2 more than 3.5%. The data was analyzed using statistical package for social sciences (SPSS) software version 17.

Results: A total of 2279 individual were enrolled in the study. Among them 2061 (90.4%) were males and 218 (9.6%) were females. Out of 2061 males, 91 (4.41%) were found to have beta thalassemia trait whereas among females only 6 (2.75%) out of 218 had beta thalassemia trait. The overall frequency of beta thalassemia trait was found to be 4.25%.

Conclusion: The overall frequency of beta thalassemia trait in our study was found to be 4.25%. Thalassemia screening should be carried out along with normal health screening tests at least once in lifetime.

Keywords: Beta Thalassemia Trait, Haemoglobinopathies, Thalassemia.

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INTRODUCTION

Haemoglobinopathies are group of disorders resulting from qualitative and quantitative disorders of hemoglobin. The word thalassemia was derived from Greek word Thalassa (sea) and Mias (blood)¹. Disorder resulting from significant decrease in the rate of synthesis of one or more globin chains is called thalassemia². The predominant mode of inheritance of thalassemia is autosomal recessive. Thalassemias are described as heterogeneous group of genetic disorders of haemoglobin synthesis. They were recognized in USA and Italy between years 1925-1927³. Thalassemia is among the commonest genetic disorders in Pakistan and worldwide⁴. There is yearly increase of approximately 9000 patients to

already existing Thalassemia patients' pool in Pakistan. The prevalence of beta Thalassemia is most common among population of mediterranean countries, India, Africa, South East Asia, Central America and Middle East. Beta thalassemia is a major problem in Pakistan. Thalassemia carrier rate in Pakistan is 5-7% with approximately 9.8 million carriers in general population^{5,6}. Beta thalassemia is clinically subdivided into thalassemia major, thalassemia intermedia and thalassemia minor. Thalassemia major patients have inherited both abnormal alleles and have severe anaemia with regular red cell transfusion requirement. In thalassemia intermedia patients have both abnormal alleles but have milder symptoms as compared to Thalassemia major. Thalassemia minor has one abnormal allele and is clinically asymptomatic. There are various techniques for the detection of thalassemia trait. Complete blood counts, single tube

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osmotic fragility test, haemoglobin electrophoresis, high performance liquid chromatography and molecular methods are among the most commonly employed methods for thalassemia screening

In countries with high thalassemia gene frequency, clinically symptomatic thalassemia contributes significantly to their overall disease burden. Many countries have reduced this burden through control programs such as carrier screening, prenatal diagnosis, pre marital screening, extended family screening along with awareness in population through large scale education and counseling. Carrier screening carries dual advantage of differentiation from microcytic hypochromic iron deficiency anaemia and genetic counseling. The aim of our study was to determine the frequency of beta thalassemia trait among asymptomatic healthy individuals. The importance of this study was that the carrier population could be given genetic counseling and advised about family screening.

PATIENTS AND METHODS

This study was carried out at pathology department of PAF Hospital Lahore from January 2016 to June 2017. The candidates who came from all over Pakistan for appearing before the Central Medical Board for selection in Pakistan Air Force were considered for sampling. Ethical approval from ethical committee of the hospital was obtained before the commencement of the study. Verbal informed consent was taken from all candidates. This was a descriptive cross sectional study with non-probability convenience sampling. All candidates who were healthy and having normal general physical examination were included in the study. A total of 2279 individuals who met the inclusion criteria were enrolled in the study. Disposable syringes were used to collect 3ml of venous blood in EDTA containing tube. Tubes were properly labeled following collection of blood. Their complete blood counts i.e. Total red cell count (TRBC), Hematocrit (HCT), Mean Corpuscular Volume (MCV), Mean corpuscular haemoglobin (MCH), Mean corpus-

cular haemoglobin concentration (MCHC and Haemoglobin (Hb) were measured on Sysmex KX 21 hematology analyzer. Subjects having with microcytic hypochromic indices with normal Hb or with mild anaemia (having Hb \geq 8.0g/dl for females and Hb \geq 9.0g/dl for males) were screened for beta thalassemia trait. Haemoglobin electrophoresis was carried out on cellulose acetate paper strips at a PH 8.5 as described in Dacie and Lewis⁷. Hb A2 estimation was done by measuring the absorbance of elute on spectrophotometer. Beta thalassemia was diagnosed if the subject had Hb A2 more than 3.5%. The data was analyzed using statistical package for social sciences (SPSS) software version 17 and descriptive statistics were used to describe the results.

RESULTS

A total of 2279 candidates were enrolled in the study. Their ages were between 18 years and 28 years. Marital status of all candidates was single. Majority of the candidates belong to Punjab province of Pakistan 1493 (65.6%). Whereas, candidates resident of Sind, KPK, Baluchistan, Azad Kashmir were 112 (4.9%), 602 (26.4%), 15 (0.65%) and 57 (2.5%) respectively. Among total of 2279 candidates, 2061 (90.4%) were males and 218 (9.6%) were females. Male were predominant population among the candidates with ratio of 10.5:1. Out of 2061 males, 91 (4.41%) had having beta thalassemia trait whereas among females only 6 (2.75%) out of 218 carried beta thalassemia trait. The frequency of beta thalassemia trait according to residence of candidates was 3.68% (Punjab), 5.1% (KPK), 5.35% (Sind), 13.33% (Baluchistan) and 5.26% (Azad Kashmir). The overall frequency of beta thalassemia trait was found to be 4.25. The mean and SD values of haemoglobin, red blood cell count, MCV, MCH and MCHC of candidates with beta thalassemia trait are shown in table.

DISCUSSION

In our study the frequency of beta thalassemia trait was 4.25%. The results were quite comparable with other studies carried out in different regions of Pakistan. A carrier

frequency of 4% has been reported in study carried out in Rawalpindi Islamabad region⁸. Whereas prevalence reported in studies conducted in Karachi and northern Pakistan was 5.5% and 5.4% respectively^{9,10}. However, the frequency reported in our study was higher as compared to international studies carried out in neighboring countries. In a study conducted in southern China by Xu *et al*, the prevalence reported was 2.54%¹¹. Similarly, a study from Hong Kong reported prevalence of 3.4% in their study¹². Thalassemias are described as heterogeneous group of genetic disorders of haemoglobin synthesis. These are characterized by either reduced rate (β^+) or absent (β^0)

frequency observed in our study among subjects from Punjab province is low (3.6%) in comparison to this study. A high frequency beta thalassemia trait is reported in Pathans (7.96%)¹⁰. However, prevalence reported in our study from KPK subjects was quite low (5.1%). The prevalence of beta thalassemia trait in families of thalassemic patients is very high as compared to frequency in general population. Ahmed *et al* reported frequency of 31% carriers in families of Thalassemic patient¹⁷. Similarly frequency reported by Khattak *et al*¹⁸ and Ansari *et al*¹⁹ was 58% and 62.2% respectively among siblings of thalassemia patient families. In Pakistan cousin marriages are quite common. As a result, gene for

Table: Haematological parameters of candidates with beta thalassemia trait.

Haematological parameters	Beta thalassemia trait subjects (n=97) (Mean \pm SD)
RBC count (10 ¹² /l)	5.8 \pm 0.9
Haemoglobin (g/dl)	12.1 \pm 2.2
MCV (fl)	62.7 \pm 6.4
MCH (pg/dl)	19.8 \pm 2.1
MCHC (g/dl)	31.3 \pm 1.1

synthesis of one or more globin chains. Typically patients having β^0 thalassemina trait have low normal Hb levels, low MCV, MCH and raised TRBC. The frequency of beta thalassemia trait in our study among subjects belonging to Azad Kashmir was 5.26% which is almost similar to frequency reported from study conducted in Muzaffarabad (5.6%)¹³. The prevalence of thalassemia trait reported among Quetta city residents is 6.5%¹⁴. However, frequency in our study from Baluchistan residents is 13.3%. The most likely reason for high frequency is very small sample size of Baluchistan residents. A frequency of 5.35% was found among candidates from Sind province. Whereas a study conducted in Nawabshah district of Sind reported a low frequency of 4.9%¹⁵ among students of school, colleges and universities of Nawabshah. In another study from Hyderabad district of Sindh, frequency of beta thalassemia trait among pregnant women was found to be 8.5%¹⁶. A study from twin cities of Rawalpindi and Islamabad reported a carrier frequency of 4.05%⁸. Whereas,

recessive disorder like thalassemia gets trapped in families where consanguineous marriages are common. This is the most likely reason of having high frequency of thalassemia trait in families with thalassemic child. Genetic counseling is one of the important steps in thalassemia prevention following diagnosis of thalassemia trait. In our study all subjects found to be having beta thalassemia trait were offered genetic counseling. Ethical principles were followed during genetic counseling which includes autonomy of patient, confidentiality and religious and social norms. They were explained regarding cause and nature of the disease. Diagnostic facilities, thalassemia prevention centres available in various provinces of Pakistan were communicated to them for family screening. They were also informed for estimated genetic risk for parents and family members. One of the major approaches towards prevention of thalassemia is through screening programs. Prenatal diagnosis is central to effective control of thalassemia. Several countries across the globe, especially mediterranean and

western countries have succeeded to achieve a significant decrease in the homozygote population with successful implementation of screening programs²⁰. There are several screening programs employed for prevention of Thalassemia. It includes preschool/school/ college screening, premarital screening, extended family screening and mass screening. Premarital screening program of the couples has been very successful in Iran and Turkey^{21,22}. This program was in practice in era when termination of pregnancy was not an option in Iran. Currently Iran is running an effective antenatal diagnostic program resulting in decrease in homozygous Thalassemics births²³. Public awareness programs along with screening programs are equally important in prevention of Thalassemia. Mass education can be achieved through electronic and print media, organizing seminars and symposia for health care professionals, parents, teachers and employees. Active involvement of social workers, religious leaders, and political figures in awareness campaigns carries added advantage. The lifetime cost of healthcare facility in managing and treating thalassemia major child is very high as compared to cost incurred on prevention and screening campaigns. An analysis carried out in Mediterranean countries and UK shows that cost on prevention is equivalent to treatment cost for one year²⁴.

CONCLUSION

The overall frequency of beta Thalassemia Trait in our study was found to be 4.25%. Thalassemia screening should be carried out along with normal health screening tests at least once in lifetime.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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